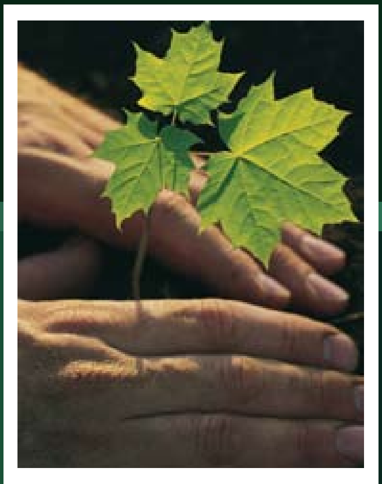
NOAA's...



2006 Annual Report

...National Climatic Data Center

A Paleo Perspective on...Global Warming

What is Global Warming?

The term ***Global Warming*** refers, without any implications for the cause or magnitude, to the observation that the atmosphere near the Earth's surface is warming. This warming is one of many kinds of climate change that the Earth has gone through in the past and will continue to go through in the future.

Temperature increases will have significant impacts on human activities, including: where we can live, what food we can grow, how and where we can grow food, and where potentially damaging organisms can thrive. To be prepared for the effects of these potential impacts we need to know how much the Earth is warming, how long the Earth has been warming, and what has caused the warming. Answers to these questions provide us with a better basis for making decisions related to issues such as water resources and agricultural planning.

Polar bear forages on dry ground, Barrow AK © 2002 Braasch

Our planet absorbs radiant energy from the sun and emits some of that energy back to space. The term greenhouse effect describes how water vapor, carbon dioxide, and other "greenhouse" gases in the atmosphere alter the return of energy to space, and in turn, change the temperature at the Earth's surface. These greenhouse gases absorb some of the energy that is emitted from the Earth's surface, preventing this energy from being lost to space. As a result, the lower atmosphere warms and sends some of this energy back to the Earth's surface. When the energy is "recycled" in this way, the Earth's surface warms.

Life on Earth would be very different without the greenhouse effect. The greenhouse effect keeps the long term annual average temperature of the Earth's surface approximately 32°C (or about 58°F) higher than it would be otherwise.

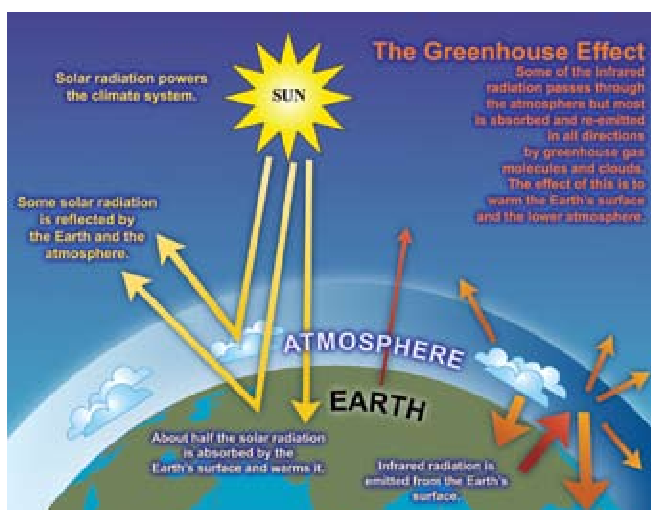
What is the greenhouse effect, and is it affecting our climate?

How is the Greenhouse Effect Related to Global Warming?

"The farther backward you can look, the farther forward you are likely to see."
- Winston Churchill

Greenhouse gases occur naturally in the Earth's atmosphere, but are also being added by human activities. This happens primarily through the burning of fossil fuels, such as coal, oil and natural gas, which releases carbon dioxide into the atmosphere. Over the past century, atmospheric carbon dioxide (as measured from ice cores) has increased due to human activities from 300 to 380 parts per million (ppm), and the average Earth temperature has increased approximately 0.7°C (or about 1.3°F).

Given what we know about the ability of greenhouse gases to warm the Earth's surface, it is reasonable to expect that as concentrations of greenhouse gases in the atmosphere rise above natural levels, the Earth's surface will become increasingly warm. Many scientists have now concluded that global warming can be explained by a human-caused enhancement of the greenhouse effect.



When one reviews all the data, both from thermometers and paleotemperature proxies, it becomes clear that the Earth has warmed significantly over the last 140 years. Global warming has occurred. Multiple paleoclimatic studies indicate that recent years, the 1990s, and the 20th century are all the warmest, on a global basis, of at least the last 1000 years. The most recent paleoclimate data reinforce this conclusion using longer records, new proxies, new statistical techniques, and a broader geographic distribution of paleo data.

CONTENTS

Director's Message

During 2006, the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) accomplished a variety of key activities, related to data set development, climate monitoring, observing system effectiveness, a variety of services, and climate assessments. NCDC has a distinctive role within NOAA, acting as our Nation's scorekeeper regarding climate trends and anomalies, while also providing a wide variety of climatic data to our diverse customer base. In partnership with organizations, both internal and external to NOAA, I am pleased to report that NCDC met or exceeded all its performance measures during 2006, sometimes surpassing them by a considerable margin. Each year offers new challenges in providing climate data and products of the highest-quality to meet the needs of society and to do so reliably and timely.

NCDC plays a central role in providing access to weather and climate data, which serves broad social and economic interests. Climate data are used in business decision-making across many different industries including agriculture, transportation, utilities, and manufacturing, to name a few. Emergency planners and decision-makers also use this information to promote environmental awareness, public safety, homeland security, the protection of property, and sustainable development. In the broadest perspective, the Department of Commerce's Bureau of Economic Analysis estimates that at least 1/3 of the United States Gross Domestic Product is climate sensitive, a potential impact of $4 Trillion a year.

In addition to traditional weather and climate services, NCDC's climatic data are also used in key national and international scientific assessments. Our scientists participated in several of these assessments including the Climate Change Science Program (CCSP) report on "Temperature Trends" (1.1), the CCSP report on "Climate Extremes" (3.3), and the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report. Public awareness, media interest, and the scientific consensus in support of global climate change is increasing, as these assessments detail the state of the science and provide valuable information for policy decision-making. NCDC scientists are also involved in the development of a National Integrated Drought Information System, which will provide an integrated, interagency drought monitoring and forecasting system for the Nation.

It is important to note that the achievements identified in this report and many others not listed are a result of the extraordinary efforts put forth by NCDC's talented and dedicated personnel, often working with other NOAA and non-NOAA colleagues. NOAA and the Nation are extremely grateful. We will continue to collaborate within and outside NOAA to develop new climate data resources and applications, in order to meet the needs of our Nation's people. Together, we can make 2007 an even more productive year.

Thomas R. Karl

Thomas R. Karl
Director

NOAA Reports 2006 Warmest Year on Record for U.S. General Warming Trend, El Niño Contributes to Milder Winter Temperatures

The 2006 average annual temperature for the contiguous United States (U.S.) was the warmest on record and nearly identical to the record set in 1998, according to scientists at NOAA's NCDC in Asheville, North Carolina. Seven months in 2006 were much warmer than average, including December, which ended as the fourth warmest December since records began in 1895.

Based on preliminary data, the 2006 annual average temperature was 55°F - 2.2°F (1.2°C) above the 20th Century mean and 0.07°F (0.04°C) warmer than 1998. NOAA originally estimated in mid-December that the 2006 annual average temperature for the contiguous United States would likely be 2°F (1.1°C) above the 20th Century mean, which would have made 2006 the third warmest year on record, slightly cooler than 1998 and 1934, according to preliminary data. Further analysis of annual temperatures and an unusually warm December caused the change in records.

These values were calculated using a network of more than 1,200 U.S. Historical Climatology Network stations. These data, primarily from rural stations, have been adjusted to remove artificial effects resulting from factors such as urbanization and station and instrument changes which occurred during the period of record.

An improved data set being developed at NCDC and scheduled for release in 2007 incorporates recent scientific advances that better address uncertainties in the instrumental record. Small changes in annual average temperatures will affect individual rankings. Although undergoing final testing and development, this new data set also shows 2006 and 1998 to be the two warmest years on record for the contiguous U.S., but with 2006 slightly cooler than 1998.

The unusually warm temperatures during much of the first half of the cold season (October-December) helped reduce residential energy needs for the Nation as a whole. Using the Residential Energy Demand Temperature Index (REDTI - an index developed at NOAA to relate energy usage to climate), NOAA scientists determined that the Nation's residential energy demand was approximately 13.5 percent lower than what would have occurred under average climate conditions for the season.

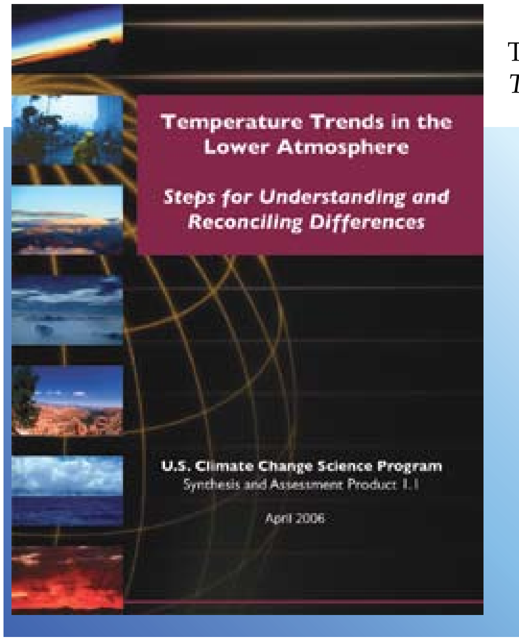
After a cold start to December, the persistence of spring-like temperatures in the eastern two-thirds of the country during the final two to three weeks of 2006 made this the fourth warmest December on record in the U.S., and helped bring the annual average to record high levels. For example, the monthly average temperature in Boston was 8°F above average, and in Minneapolis-St Paul, the temperature was 17°F above average for the last three weeks of December. Even in Denver, which had its third snowiest December on record and endured a major blizzard that brought the city to a standstill during the holiday travel season, the temperature for the month was 1.4°F warmer than the 1971-2000 average.

Five states had their warmest December on record (Minnesota, New York, Connecticut, Vermont, New Hampshire) and no state was colder than average in December.

The unusually warm start to this winter reflected the rarity of Arctic outbreaks across the country as an El Niño episode continued in the equatorial Pacific. A contributing factor to the unusually warm temperatures throughout 2006 is the long-term warming trend, which has been linked to increases in greenhouse gases. This has made warmer-than-average conditions more common in the U.S. and other parts of the world. It is unclear how much of the recent anomalous warmth was due to greenhouse-gas-induced warming and how much was due to the El Niño-related circulation pattern. It is known that El Niño is playing a major role in this winter's short-term warm period.

U.S. and global annual temperatures are now approximately 1.0°F warmer than at the start of the 20th century, and the rate of warming has accelerated over the past 30 years, increasing globally since the mid-1970s at a rate approximately three times faster than the century-scale trend. The past nine years have all been among the 25 warmest years on record for the contiguous U.S., a streak which is unprecedented in the historical record.

CCSP 1.1 Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences



The first CCSP Synthesis and Assessment Report (S&A) entitled "*Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences*," was released on May 2, 2006. This report provides an update to the conclusions of earlier U.S. National Research Council (NRC) and IPCC reports, concluding that there is no longer a significant discrepancy between global temperatures measured at the surface with in situ observing systems compared to those measured in the troposphere by satellites (and weather balloons). Discrepancies in the rates of temperature changes, however, remain to be resolved in the tropics (20°N to 20°S). Chief Editor Dr. Thomas Karl, Director of NOAA's NCDC stated, "Discrepancies between the data sets and the models have been reduced and our understanding of observed climate changes and their causes have increased." Previous temperature discrepancies in surface and upper-air observations were used by skeptics to question the validity of climate models, but new evidence of a warming upper and lower troposphere continues to support a substantial human impact on global temperature increases. This new scientific evidence should constitute a valuable source of information to policymakers

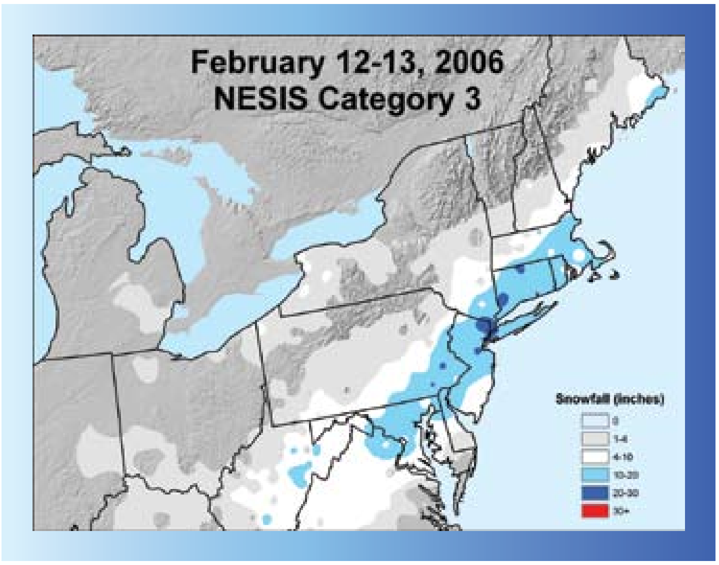
The report's conclusions were reached after an exhaustive synthesis and assessment of observations and models. The report identified and clarified corrections to satellite data and other observational data. Such corrections were related to complications due to time varying biases in the long-term record of upper tropospheric temperatures. These complications evolve while a satellite is in orbit (i.e. diurnal drifting, inter-satellite biases, and degradation of instrument calibration over time). Scientists involved in compiling the report discerned that the correction of errors identified in the satellite data and other temperature observations were attributable to previous experimental uncertainties and errors in data analysis. S&A Product 1.1 provides substantial evidence in outlining the remaining differences between observing systems and their data sets and their relationship to recent changes in tropospheric and stratospheric temperature.

The report was assembled by a Federal Advisory Committee (FAC) and vetted through NRC, public review, the CCSP agency principals, and the National Science and Technology Council. The FAC consisted of an expert team of 21 internationally known climate scientists.

Following the release of this report, Chief Editor, Dr. Karl, and selected Convening Lead Authors (Drs. Tom Wigley, John Christy, and John Lanzante) presented results to an American Meteorological Society sponsored Capitol Hill briefing entitled "Temperature Trends in the Lower Atmosphere. Observations, Models, and Theory: A Synopsis of the recent U.S. CCSP Synthesis and Assessment Report 1.1."

Operational Implementation of Northeast Snowfall Impact Scale

NCDC's Scientific Services Division in collaboration with the Director of NOAA's National Centers for Environmental Prediction (NCEP) and The Weather Channel's winter weather expert, Paul Kocin, developed an operational implementation of the Northeast Snowfall Impact Scale (NESIS). This impact scale now gives the public a new, easy-to-understand scale to categorize major snowstorms after they strike the Northeast, using a ranking scale similar to those used to categorize the strength of tornadoes and hurricanes.



Before this effort there was no way of measuring a snowstorm's intensity with an index as understandable as the Saffir-Simpson scale for hurricanes, or the Fujita scale for tornadoes. While winds are used to measure hurricane intensity, NESIS ranks the severity of an East Coast snowstorm based on snowfall amount and the population of the affected areas. With NESIS, scientists at NCDC can quickly assess a snowstorm's impact today, compare it with a storm of the past and assign it one of five categories: Notable, Significant, Major, Crippling or Extreme. Snowfall observations are quickly collected and quality controlled as each event unfolds then combined with the new NESIS system to provide preliminary snowstorm assessments in days instead of weeks. NESIS also offers a way to better assess the impact of major snowstorms on the population.

The NESIS got its first true test when a snowstorm struck the eastern seaboard on the second weekend of February 2006 bringing airlines and roadways to a standstill in some of the Nation's biggest cities. The storm was classified as "Major" or a Category 3 storm on the NESIS scale. Blizzard and near-blizzard conditions prevailed in the Northeast, with winds gusting more than 50 mph along the coastal areas. The development and movement of the storm off the Atlantic coast produced the highest storm totals along the coastal corridor, while missing areas from western Pennsylvania to northern New England.

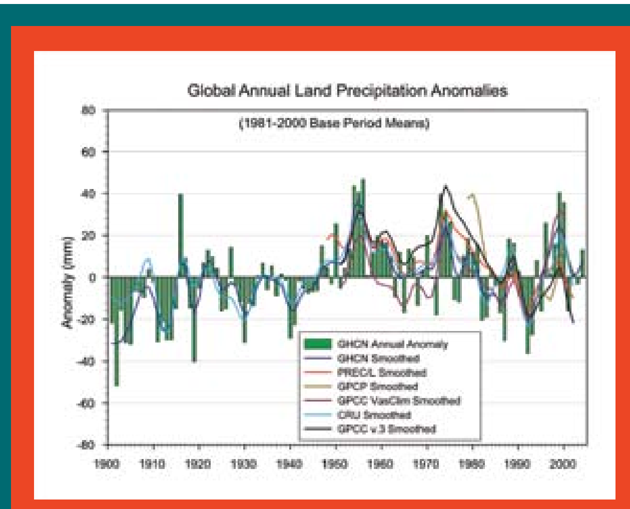
The highest snowfall amounts fell from New York City to Connecticut. In New York City's Central Park, where record-keeping began in 1869, 26.9 inches of snow fell in a 24-hour period, breaking the previous storm total record of 26.4 inches set during a December 26-27, 1947 storm. Other major snowstorms of the recent past, such as the 1993 Storm of the Century (NESIS Category 5), covered areas throughout the eastern U.S., while also bringing heavy snowfall to interior regions.

In developing this operational NESIS, NCDC scientists combined a mathematical model that Kocin and Uccellini developed into an automated Geographical Information System (GIS) to determine the magnitude of each major snowstorm within a day after it strikes. A new project is now underway in collaboration with researchers at Rutgers University to extend the NESIS back to the late 19th century and to develop similar impact scales for other regions of the U.S. This work will be completed prior to the start of the 2007-2008 winter season. The NESIS is available on-line at http://www.ncdc.noaa.gov/oa/climate/research/snow-nesis/.

NCDC National and International Assessment Research

Participation in scientific assessments and the development of decision support products are activities that are critically important to addressing NOAA and NCDC goals in understanding climate variability and change, and providing products useful for societal decision making. NCDC personnel participated in one finished and three ongoing scientific assessments during Fiscal Year 2006 (FY). These assessments include the IPCC Fourth Assessment Report (AR4) scheduled for release in February 2007, where NCDC provided two lead authors, one review editor, six contributing authors, as well as providing significant graphics support.

A major component of the administration's CCSP is the production of a total of twenty-one synthesis and assessment products that address critical issues in climate change. The first product examines the issue of varying



Time series of annual global land precipitation anomalies with respect to the 1961–90 base period for 1900 to 2004 (to convert to mm/day divide by 365 or 366). Smoothed values (using the 5-point filter in Appendix 3.A) are also given for the GHCN (Peterson and Vose, 1997), PREC/L (Chen et al. (2002)), GPCP (Adler et al., 2003), GPCC (Rudolf et al., 1994) and CRU (Mitchell and Jones, 2005).

trends in temperature between the surface and free atmosphere. This report, CCSP Synthesis Product 1.1, was published in 2006 and NCDC was instrumental in its production by providing one of the four lead editors, and two lead authors. NCDC also provided all graphics and production support for this report. Furthermore, five NCDC personnel are participating in the CCSP 3.3 product on Weather and Climate Extremes in a Changing Climate, and one is participating in the CCSP 3.4 product on Abrupt Climate Change.

NCDC-led Report on "Climate Variability and Change with Implications for Transportation"

The potential impact of climate change on the Nation's transportation infrastructure was investigated by a NOAA team led by NCDC's Dr. Thomas C. Peterson. In a paper commissioned by the National Academy of Science's Transportation Research Board, impacts to shipping, air transport, roadways and rails were investigated. Dr. David Karoly, who serves on the World Meteorological Organization Expert Team on Climate Change Detection and Indices, presented the paper entitled "Climate Variability and Change with Implications for Transportation" at the National Academy of Sciences in Washington, D.C., in October 2006. The paper summarized the current understanding of the climate variability and change that will likely challenge transportation professionals in the future. The paper was a focused examiNation of those aspects of climate variability and change of greatest relevance for transportation. The paper identified areas of greater and lesser uncertainty in our understanding of climate variability relevant to transportation infrastructure and operations. It also provided detailed elaboration of relevant climate variables thresholds at regional and local levels (e.g., snowmelt in the west, drought in the interior) and with different time durations (e.g., long droughts versus hurricanes).

The presentation was made to an invited group of a few climatologists and many engineers and planners. Much of the meeting discussed decision making under uncertainties and provided a window into the thought process of some important consumers of climate information. Dr. Peterson's co-authors were Marjorie McGuirk and Tamara Houston, also of NOAA's NCDC, Andrew H. Horvitz of NOAA's National Weather Service (NWS) and Michael S. Wehner of Lawrence Berkeley National Laboratory.

High Altitude and High Latitude Climate Reference Observations

In line with the Earth Observation Partnership of the Americas, which is a formally recognized regional implementation of the Group on Earth Observations [http://www.earthobservations.org/index.html], the World Bank has formally partnered with NOAA's NCDC, as well as with researchers in Bolivia, Ecuador, Japan, and Peru to investigate a project involving tropical glacier monitoring in the High Andes of South America (e.g., the American Cordillera) with the goal of providing improved climate observation data in high elevation locations in this region to aid in monitoring the decline of tropical glaciers. This is part of a greater World Bank effort to quantify the impacts of rapid glacier retreat in the Andes related to key human impacts involving drinking and agricultural water supplies, human and ecosystem health, and power generation. Furthermore, in concert with the International Polar Year's International Arctic Systems for Observing the Atmosphere project, NCDC will be working with a NOAA-wide Arctic climate team to install a Climate Reference Network site configuration at an existing observatory in the Russian Arctic in Tiksi, that is north of the Arctic Circle at a latitude of 71.5º North.

State-of-the-art climate stations can instrument the Andes and Sierra Mountains of South and Central America. A Cordillera Climate network would be spaced vertically at selected intervals along a chain at or near the upper treeline. Medium-level stations would be near the lower treeline. A third chain could tie into at least 13 national meteorological networks at low elevations. Observations would be reported via satellite to national and international data centers.

Cordilea Central Andes Mountains

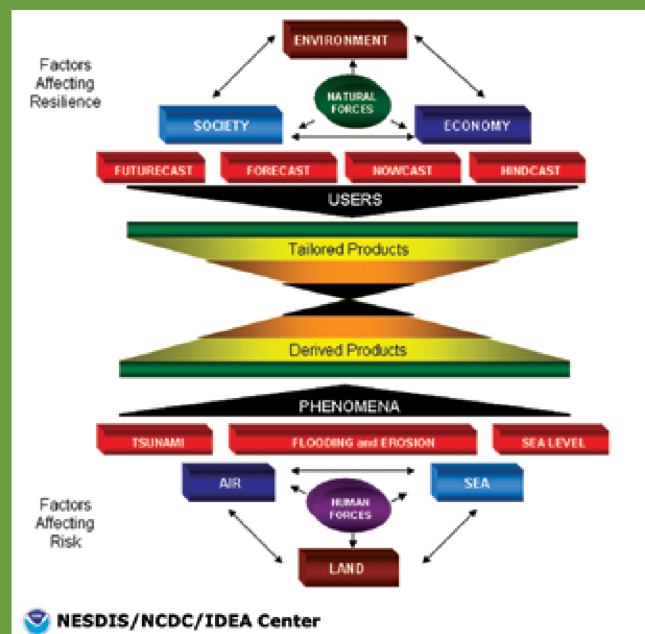
The first Synthesis and Assessment product produced by the U.S. CCSP, Product 1.1, *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences*, which was released in April 2006 and has specific recommendations related to the Global Climate Observing System (GCOS) with particular emphasis on the need for reference climate observing sites. That report is posted at http://www.climatescience.gov/Library/sap/sap1-1/finalreport/default.htm. Since data from reference high elevation and high latitude sites are critical to filling in gaps called for in the CCSP report, the GCOS Program at NCDC [http://www.ncdc.noaa.gov/oa/usgcos/index.htm] will be working in continuing to develop partnerships such as those detailed here.

IDEA Center 2006 Accomplishments I: Marine Technology Society (MTS)

Journal Special Issue Article "An Integrating Architecture for Coastal Inundation and Erosion Program Planning and Product Development"

Staff from the NOAA Integrated Data and Environmental Applications (IDEA) Center, working in conjunction with staff from the NOAA Coastal Services Center (CSC) and NOAA Climate Program Officer as well as NCDC staff, drafted the article "An Integrating Architecture for Coastal Inundation and Erosion Program Planning and Product Development" for inclusion in a special issue of the (MTS) Journal. This article describes a conceptual framework for an integrating architecture that would support program planning and product development toward hazard resilient communities. Key elements built into the architecture include end-user connections and relevance; problem diagnosis and treatment through a horizontally and vertically integrated view of the physical and social systems that shape the risks associated with coastal inundation and erosion; effective integration of an extensive range of required scientific and management expertise; meaningful coordiNation and collaboration among scientists, practitioners, and policy makers; and commitment to fill existing gaps in knowledge, applications, and outreach.

The proposed architecture not only responds to a prime social and economic need, but also addresses a significant scientific challenge because the phenomena affecting coastal inundation and erosion are complex and varied, and are often expressed in combiNations unique to a given time and place. Further, it addresses a significant societal challenge because the potential users of information are diverse in terms of their responsibilities and their specific requirements for information content, precision, formatting, and timeliness. While outlining the complexity of the problem, the



Coastal Inundation and Erosion Integrated System Architecture: This figure depicts the basic construct for defining the elements of the coastal inundation and erosion problem and delineating the relationships among and between them.

• The top is the social system and the combiNation of factors within it that affect community resilience and that, in turn, drive end-user product and service requirements in terms of content, format, timing, and delivery.

• The bottom is the physical system and the combiNation of factors within it that, through their interaction, generate the different inundation and erosion phenomena that affect risk.

• The center of the figure are the connections between the social and physical systems. Depicted as an hourglass, *it represents the transition from derived data, through the development of applied data products and decision-support tools, to the production of a tailored information suite applicable to a wide range of users, and the iterative, two-way interactions among producers and users that leads to the creation of these data and information products.*

proposed framework also provides evidence to suggest that the ability to address many key questions already exists. The architecture acknowledges and even takes advantage of the differentiated treatment of the problem that has been the foundation of scientific studies of coastal inundation and erosion to date. The architecture emphasizes the importance of focusing on the linkages required to seamlessly integrate the various pieces of the puzzle in a way that addresses local, regional and national needs, and that forms a basis for developing comprehensive and decision-support-oriented programs of research, products, and services. The desired outcome is that users, through the application of the proposed architecture, will have timely access to information that is both accurate and appropriate, and, as such, will afford them the opportunity to plan accordingly. As a result, the resilience and adaptive capacity of coastal communities affected by inundation and erosion will be enhanced.

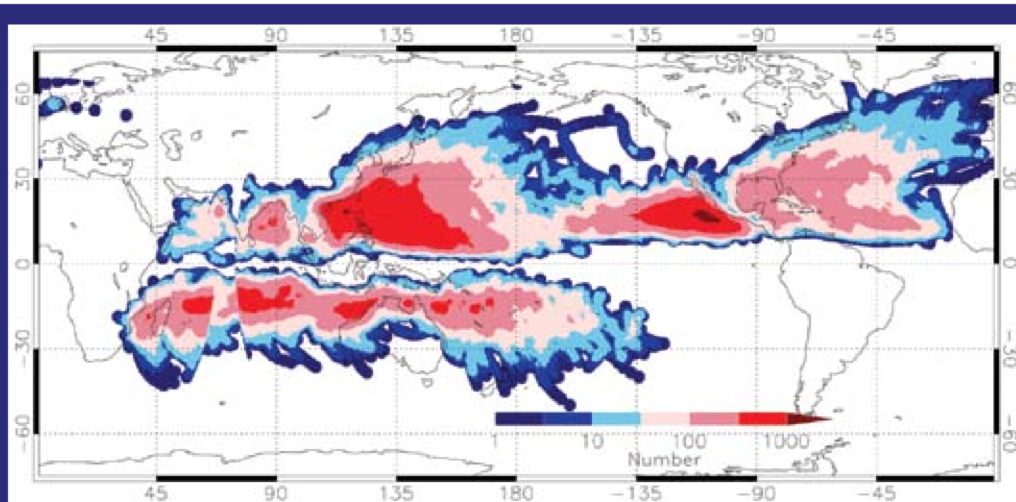
IDEA Center 2006 Accomplishments II: Tide Station Web Service to Support Tsunami Detection and Warning

Staff from the NOAA IDEA Center are working to develop a coastal inundation and erosion product line in the Pacific. One aspect of this effort involves mapping of existing data and products pertaining to tsunami hazard management as a means to support packaging of this information in way that supports easy and rapid web access to all publicly available NOAA and related products within the Pacific Region. Another aspect of this effort involves supporting the exposure and harvesting of tide station data and products in a way that virtually integrates this information for use by warning systems mangers for tsunami detection and warning.

Specifically, the Indian Ocean Tsunami of December 26, 2004, made it clear that information about tide stations that could be used to support detection and warning (such as location, collection and transmission capabilities, operator identification) are insufficiently known or not readily accessible. Parties interested in addressing this problem united under the Pacific Region Data Integrated Data Enterprise (PRIDE), and in 2005 began to develop a distributed metadata system describing tide stations starting with pilot activities in a regional framework and focusing on tsunami detection and warning systems being developed by various agencies.

First, a plain semantic description of the metadata that addressed various use cases for tide station information was developed. These use cases range from a real-time tsunami warning systems web services prototype implemented under the PRIDE 2005 program to long-range wave and water level monitoring activity relevant to issues like global warming. A formal metadata schema was then developed to, among other things, corrall input parameters for the TideTool application used by the Pacific Tsunami Warning Center to drill down into wave activity at a tide station that is located by using a web service developed on this metadata schema. Taking a standards based approach, specifically, the Open Geospatial Consortium (OGC) Sensor Web Enablement Framework, will serve all prospective stakeholders in the most useful (extensible, scalable) manner. Developing this schema, and associated client application architectures, will result in a distributed network of data providers, who are able to contribute to a global tide station metadata via their own Information Technology (IT) departments. The distributed metadata system for tide station information will also contribute to other marine hazard warning systems (such as storm surges), as well as sea level change monitoring and research.

New Hurricane Satellite Data Set Facilitates Climate Research

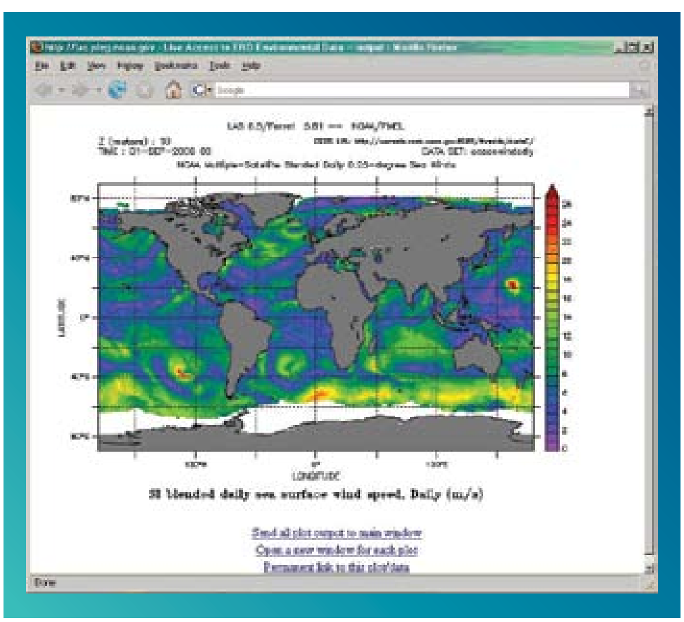


Spatial distribution of the number of HURSAT observations within 250 km of a tropical cyclone for 1983-2005. The relatively data-void region in the S. Indian Ocean was not well-sampled until the Meteosat 5 coverage data began there in 1998.

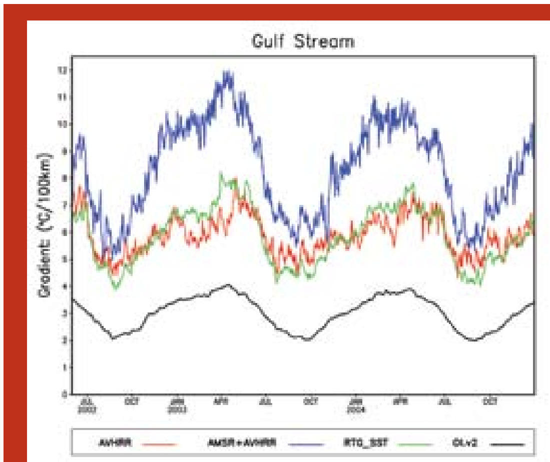
Working with scientists at the University of Wisconsin (UW), NCDC has developed a new hurricane satellite (HURSAT) data set to facilitate hurricane research. The data set captures satellite observations of tropical cyclones worldwide, in all ocean basins from 1983-2005. The data consist of observations from NOAA's Geostationary Operational Environmental Satellite (GOES) series as well as the European Meteosat series and the Japanese Geostationary Meteorological Satellite series. Using data from 18 satellites, analysis by NCDC removed inter-satellite and temporal biases creating a homogeneous record of hurricane observations. The HURSAT data set provides researchers a "one-stop" location to access thousands of observations for any of the 2,069 tropical cyclones worldwide since 1983. Researchers at UW have already used the data to objectively reanalyze the existing tropical cyclone intensity record. Research using the data will help to better understand the impact of tropical cyclones on climate variability and change.

Interoperable Marine Environmental Data and Web Service Across NOAA Line Offices

In an effort to promote a "one-NOAA" approach and provide streamlined services across different NOAA Goal Teams (Ecosystem and Climate) and Line Offices [National Environmental Satellite, Data, & Information Service (NESDIS) and National Marine Fisheries Service (NMFS)], the NCDC of NESDIS and the Environmental Research Division (ERD) of NMFS Southwest Fisheries Science Center started a pilot project for inter-operable data analysis and visualization and web services through the concept of distributed computing. This collaborative project leverages the products and resources at NCDC and ERD to provide value-added services to the public. NMFS routinely develops and disseminates a number of products and indices that characterize marine ecosystem conditions and its variability, for use by researchers, managers and decision makers. The most familiar and widely used of these products is the ocean "upwelling index" driven by wind. Recently, NCDC has started generation of high-resolution gridded sea surface wind and temperature products derived from multiple satellites and in situ observations. The new daily high resolution sea surface temperature is revolutionary to resolve ocean features such as fronts, where enhanced ocean processes can generate enhanced biological products. Through the distributed access and inter-operable data server at NCDC, ERD can acquire the NCDC data "on-the-fly" by web browsing, sub-setting, visualization and disseminating to users in their preferred formats (images, text or binary data, etc.), as shown.



Daily Blended Analysis for Sea Surface Temperature



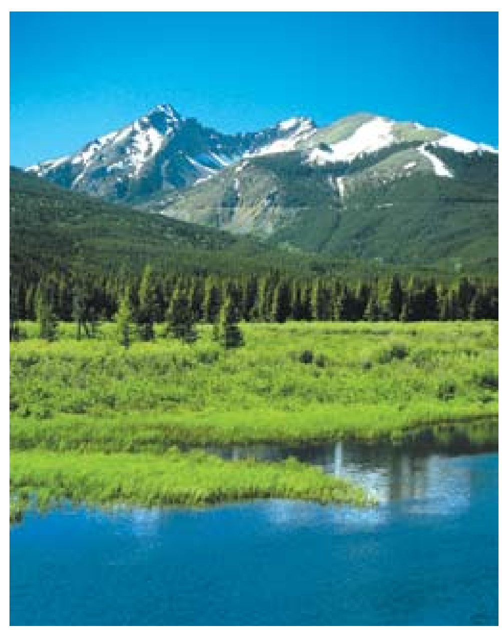
Analysis SST gradient index (see text) for the Gulf Stream region for 1 June 2002 - 31 December 2004. The analyses are the OI.v2, the RTG_SST and the daily OI using AVHRR only and AMSR+AVHRR.

Two new high resolution sea surface temperature (SST) analysis products have been developed using optimum interpolation (OI). The analyses have a spatial grid resolution of 0.25° and temporal resolution of 1 day. One product uses Advanced Very High Resolution Radiometer (AVHRR) infrared satellite SST data. The other uses AVHRR and Advanced Microwave Scanning Radiometer (AMSR) satellite SST data. Both products also use in situ data from ships and buoys and include a large-scale adjustment of satellite biases with respect to the in situ data. Two products are needed because there is an increase in signal variance poleward of 40° latitude when AMSR became available in June 2002 due to its near all-weather coverage.

To better examine the impact of the improved resolution of the daily OI, gradient indices were computed. The index for the Gulf Stream is computed from the daily magnitude of the SST gradients from June 2002 through December 2004 for the two daily OI runs: AVHRR-only, and AMSR+AVHRR and for the two additional analyses. The additional analyses are produced by NCEP and use AVHRR and in situ data. One version, the OI.v2 is analyzed weekly on a 1° spatial grid; the other, the Real-Time Global (RTG) SST, is analyzed daily on a 1/2° grid. This daily index is computed between 70°W to 40°W and 35°N to 50°N and is shown in figure. The results show that the OI.v2 index is weakest as may be expected by the larger spatial and temporal scales. The AVHRR-only and the RTG_SST indices are generally quite similar. The most interesting difference occurs between the AVHRR-only and AMSR+AVHRR gradient indices. These indices are similar in August and September. Differences gradually increase from September to roughly March and then decrease again. In winter the AMSR+AVHRR gradient index is almost double the AVHRR-only because AVHRR is negatively impacted by cloud cover which tends to be more pervasive in winter.

Tree-Ring Based Streamflow Reconstructions

Drought, population growth, and changing water needs have resulted in a reassessment of water management and drought planning in many parts of the western U.S. In particular, the drought of 2000-2004 motivated water managers to consider the extended records of streamflow from tree-ring data to evaluate this drought in the context of the past centuries. Since 2002, NCDC Paleoclimatology Branch scientist Dr. Connie Woodhouse, in concert with the NOAA/University of Colorado Western Water Assessment Regional Integrated Science Assessment and colleagues at the Universities of Arizona and Colorado, have developed partnerships with a number of local, state, and federal water managers in Colorado and the Colorado River basin to explore ways to apply streamflow reconstructions to water management and drought planning.



In an effort to clarify the science behind the reconstructions and to explore possible applications, Woodhouse and colleagues developed a series of small, regional workshops for water managers.

An on-line resource for water managers that provides hydroclimatic reconstructions, tree-ring data, information to assess the skill of the reconstructions, and a tutorial to the reconstruction process can be found at (Colorado TreeFlow, http://www.ncdc.noaa.gov/paleo/streamflow/). We have recently developed a similar web site for California (http://www.ncdc.noaa.gov/paleo/streamflow/ca) at the request of and in collaboration with the California Department of Water Resources.

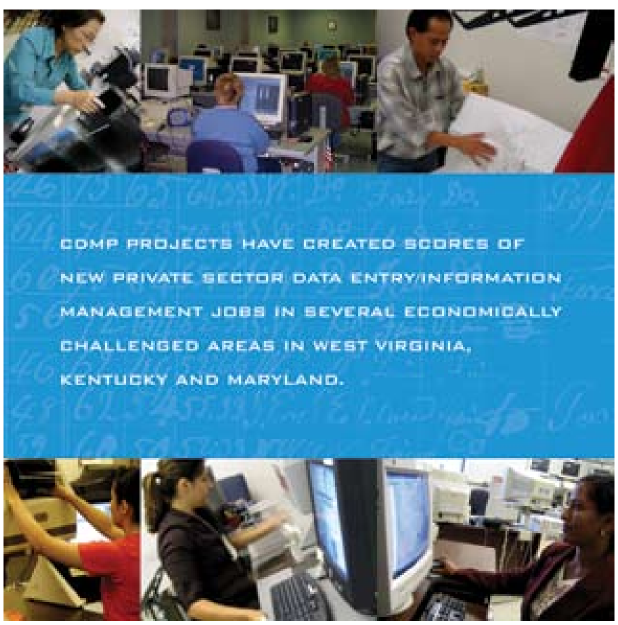
Update on Climate Reference Network (CRN) and Modernized Historic Climatology Network (HCN-M)

Two CRN stations were commissioned on November 30: Quinault, Washington and Corvallis, Oregon. That makes a total of 79 commissioned U.S. CRN stations. NCDC has a performance measure to determine national (CONUS) explained variance (%) for annual average temperature and precipitation using the U.S. CRN stations. We currently report an explained variance of (97.1%) for temperature and (91.9%) for precipitation.

The CRN management team continued planning and development of the HCN-M. What U.S. CRN is to the national climate signal, HCN-M will be to the regional climate signal. HCN-M is part of NOAA's Environmental Real-time Observation Network, a project to integrate a network of observing systems to sustain the Nation's climate record of land surface measurements essential to monitor and assess the surface climate. The Climate Goal is responsible for the HCN modernization project. The Climate Goal has assigned program management to the Climate Observations and Analysis Program. NOAA NESDIS is designated the lead line office and the NESDIS Assistant Administrator has delegated HCN-M project management authority to the NESDIS NCDC. The HCN-M project is a cross line office collaborative activity between NESDIS, NWS, and Office of Oceanic and Atmospheric Research.

Six HCN-M prototype stations have been deployed and have completed testing and evaluation phases in Alabama. These stations are based on the U.S. CRN architecture, with some on-site instrumentation/station configuration modifications. These HCN-M prototype stations are currently transmitting data to NCDC. The HCN-M prototype stations' data are ingested and processed, archived and accessed along with U.S. CRN data. The U.S. CRN processing system is a sub-system of the Integrated Surface Data Management, which is in-turn the in situ component of the Comprehensive Large Array-data Stewardship System and is registered in the NOAA Observing Systems and Data Management Inventory.

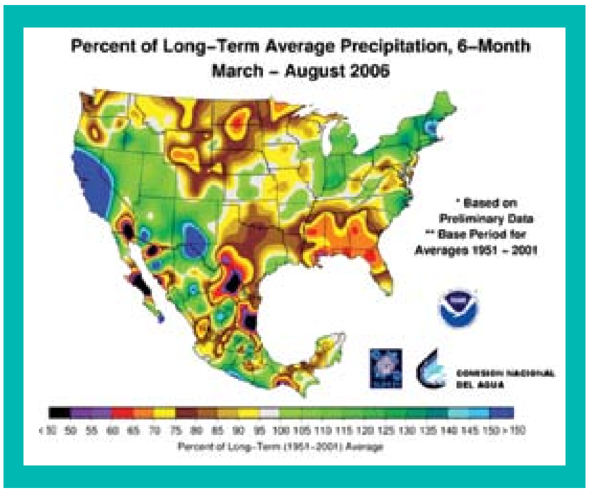
Climate Database Modernization Program (CDMP) Major Program Achievements



NOAA's CDMP has just completed its seventh year. The demand for rapid and complete access to the Nation's and world's climate data by researchers and global change scientists was a key driver in the establishment of CDMP, which is managed through NCDC. This program was initiated by Congress to assist NOAA in modernizing and improving access to the Nation's climate data and information. Partnering with four private sector contractors, CDMP has placed on-line around 50 million weather and environmental images. These historic documents are now available to researchers around the world via the Internet. The amount of data on-line has grown from 1.75 terabytes in 2001 to over 7.0 terabytes in 2006. Major advances continue in making these data available on the web through a number of NOAA web sites. During the past year, over four million hourly weather records keyed through CDMP were integrated into NCDC's digital database holdings, extending the period of record for many stations into the 1890s. CDMP-keyed daily data records will soon extend this data period back as much as another 100 years and be easily accessable for climate change and variability studies.

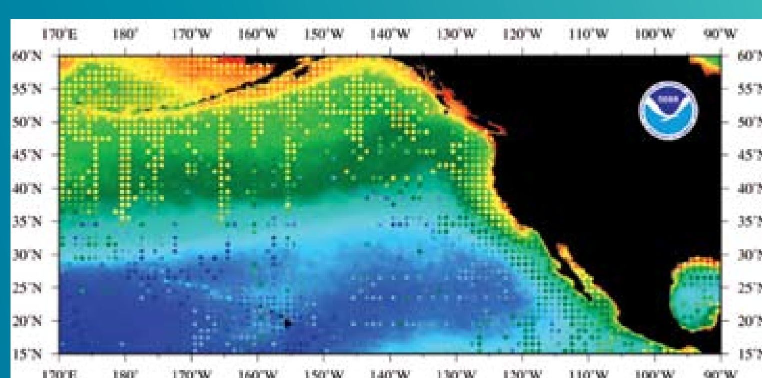
CDMP - NOAA's International Projects: NOAA data rescue efforts under the CDMP program have an international component which fosters cooperation in the exchange of data. In order to have the most complete global database available for researchers and other users, NOAA, under the CDMP program, is rescuing and digitizing data in many areas of the world where there are gaps in available global climate and environmental databases. In the past, this has included successful joint projects all over the globe, including Uruguay, Finland, Sweden, Germany, Malawi, Senegal, and Mozambique, just to name a few.

In 2006, CDMP's international reach stayed close to home, coordinating with México's National Meteorological Service (SMN – Servicio Meteorológico Nacional) in a joint venture to preserve valuable daily surface weather observations dating from 1982 to as far back as 1878. These observations are from 92 national observatory stations and about 35 cooperative observing stations located throughout México. The observations are contained in paper logbooks, stored in non-climate controlled conditions in the SMN headquarters offices in México City. These records were in danger of loss or significant deterioration from environmental hazards such as moisture, mold and insects. With the help of CDMP, imaging stations were set up at SMN headquarters. To date, all of the logbook pages (more than 431,000) have been imaged onto digital media, which has preserved these logbook entries. The imaged logbook pages are kept in México City and in at least three places in the U.S. The next step is to key the data from these images — a challenge made more difficult because the data were recorded in 20 different logbook formats. In anticipation, scientists are already envisioning ways the data will be used. These data will enhance indices used by the North America Climate Extremes Monitoring system. This important system includes the North America Drought Monitor, a cooperative effort between drought experts in Canada, México and the United States, which is an integral tool for drought planning, preparedness and mitigation efforts throughout the North American continent. The integration of these new Méxican data will improve the Drought Monitor and other aspects of this system, yet another way NOAA's international projects contribute to a better understanding of our global climate.

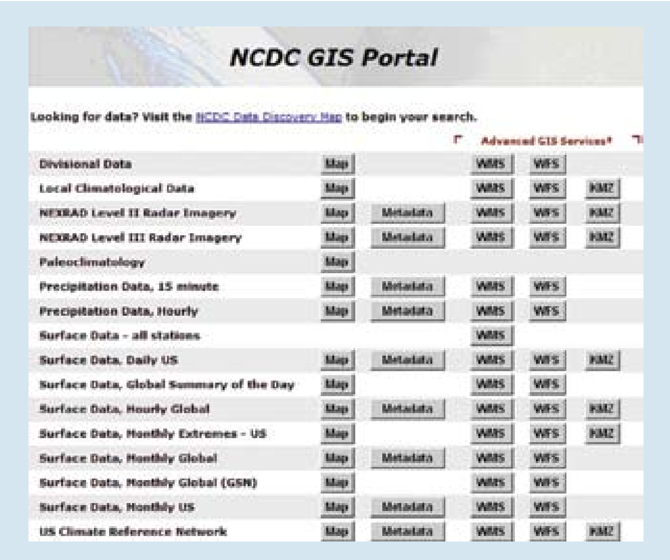


CDMP - More Than Just Climate Data: The CDMP supports many other NOAA activities. Among those are several projects related to the Earth's waters, from the shoreline to the greatest ocean depths. The Shoreline Vectorization and Access to Coastal Data project is an ongoing collaborative effort between the NOAA CSC, the National Geodetic Survey, and CDMP contractor Information Manufacturing Corporation to produce GIS-compatible shoreline data that are readily accessible to shoreline managers and the public. In this project, historic topographic manuscripts of our Nation's shoreline, called "T-sheets," are converted into vector and georeferenced raster data, creating a seamless Nationwide shoreline dataset. This dataset is distributed through the NOAA Shoreline Data Explorer web site. Through CDMP, over half of the nearly 15,000 available historic T-sheets have been converted into these valuable GIS-compatible shoreline data.

Another successful CDMP foray into the world's oceans is the CDMP Plankton Data Rescue project, managed in cooperation with the NMFS. In this project, in situ samples of marine zooplankton population – a crucial component of oceanic ecosystems and commercial fisheries – which previously only existed in paper and data table format, were keyed. This comprehensive collection of zooplankton data are available on-line via the Coastal & Oceanic Plankton Ecology, Production, and Observation Database: (www.st.nmfs.gov/plankton).



Enhanced Geographical Information System (GIS) Discovery for NOAA Climate Data



NCDC GIS Portal

Looking for data? Visit the NCDC Data Discovery Map to begin your search.

			Advanced GIS Services*		
Divisional Data	Map		WMS	WFS	
Local Climatological Data	Map		WMS	WFS	KMZ
NEXRAD Level II Radar Imagery	Map	Metadata	WMS	WFS	KMZ
NEXRAD Level III Radar Imagery	Map	Metadata	WMS	WFS	KMZ
Paleoclimatology	Map				
Precipitation Data, 15 minute	Map	Metadata	WMS	WFS	
Precipitation Data, Hourly	Map	Metadata	WMS	WFS	
Surface Data - all stations			WMS		
Surface Data, Daily US	Map	Metadata	WMS	WFS	KMZ
Surface Data, Global Summary of the Day	Map		WMS	WFS	
Surface Data, Hourly Global	Map	Metadata	WMS	WFS	KMZ
Surface Data, Monthly Extremes - US	Map		WMS	WFS	KMZ
Surface Data, Monthly Global	Map	Metadata	WMS	WFS	
Surface Data, Monthly Global (GSN)	Map		WMS	WFS	
Surface Data, Monthly US	Map	Metadata	WMS	WFS	
US Climate Reference Network	Map	Metadata	WMS	WFS	KMZ

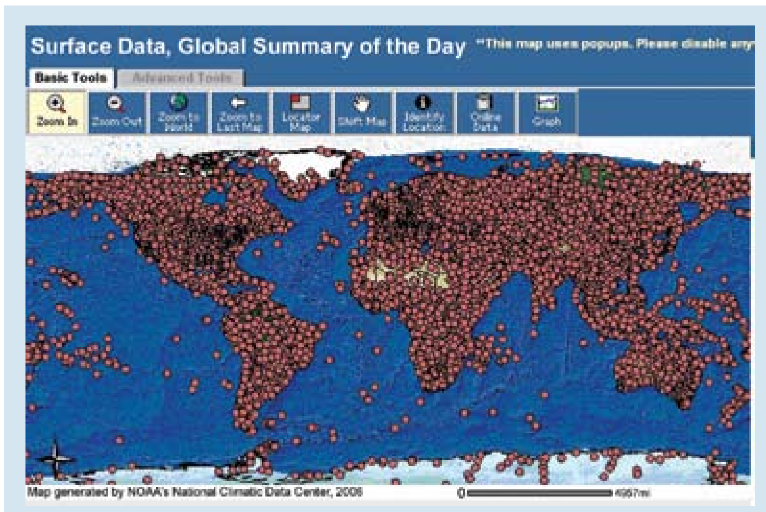
New GIS Features:

- Climate Database On-line datasets/products are accessible via the GIS data discovery tools. This provides GIS-based access, along with Web Map Service and Web Feature Service accessibility. The URL is: http://gis.ncdc.noaa.gov/ - click on "data discovery map" to proceed; or simply click on "search by map" on the NCDC homepage sidebar.

- The "Map Search" has been enhanced to utilize a 350,000+ location gazetteer. This allows users to search for data based on numerous geographic references, such as zip code, town, city, county, state, country, lake, etc. When a desired location is key-entered, the user receives a list of results, from which a specific location can be chosen. Any dataset or product can be selected to then display the locations on the GIS map where the data/product is available, in the vicinity of the chosen geographic reference point.

- Data summary classifications are available which plot/color-code stations by means and frequency distributions of various parameters, such as temperature, relative humidity, wind speed, etc. Over 12,000 global stations have this capability.

- Wind rose graphics provide frequency distributions of wind speed versus direction by station, on a compass-type grid. The service uses the most recent 10 years of hourly data as input to produce the summary in graphical form. Over 12,000 global stations have this capability.

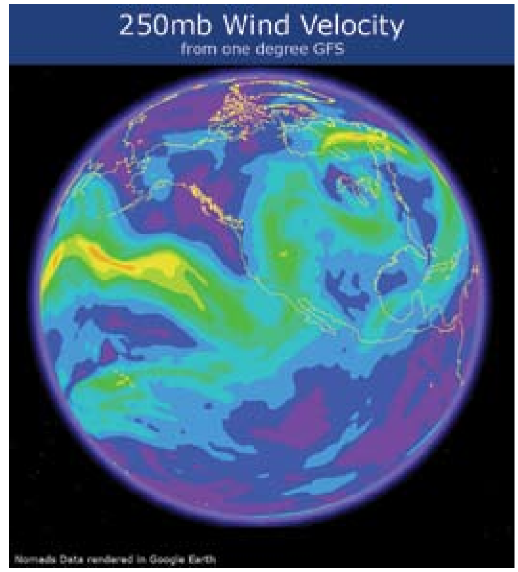


NOAA National Operational Model Archive and Distribution System (NOMADS)

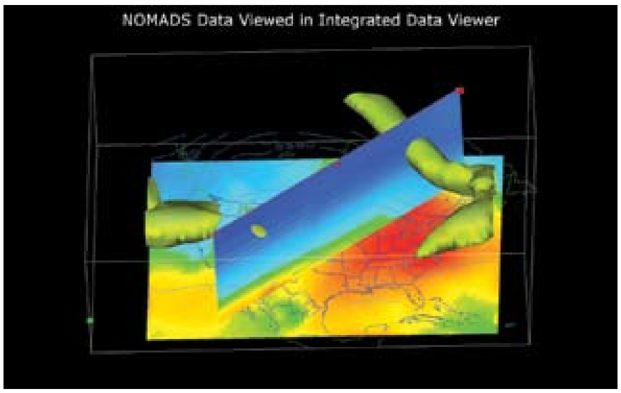
During 2006 the NOAA National Operational Model Archive and Distribution System (NOMADS) at NCDC provided approximately 72 terabytes of near real-time and historical model data from 39 million user downloads, which is more than double the total from 2005. Under a new collaboration between the NWS and NESDIS, NCDC and NCEP are jointly developing new operational requirements for the NOMADS for use within NWS operations. This will include a more robust ingest and quality control process, increased NOMADS usage within the NWS, and additional datasets including the Regional and Global Ensemble product suite. NOMADS is laying the framework to address the 2006 report from the National Academies National Research Council, Board of Atmospheric Science and Climate which concluded:

"NOMADS should be maintained and extended to include (a) long-term archives of global and regional ensemble forecasting systems at their native resolution, and (b) re-forecast datasets to facilitate post-processing".

Also during 2006, in collaboration with the National Aeronautics and Space Administration (NASA), Unidata, the George Mason University, and the Open-source Project for a Network Data Access Protocol organization. NOMADS participated in the development of an interoperable "gateway." This data model mapping across the data access protocols, and the THREDDS Data Server Catalog, and the OGC standards allows greater interoperability across both these communities and more formal structured protocols for advancing a core technologies for distributed, format neutral web services and data access.



NOMADS is providing standards based access to other data forms not just model data, including a successful research-to-operations effort to include web services access to the Smith-Reynolds Optimum Interpolation Sea Surface Temperature and Blended Sea Surface Winds datasets, derived from multiple satellites and in situ observations that are part of a PRIDE project between the NOAA Line Offices of NESDIS/NCDC and NMFS/Southwest Fisheries Science Center.



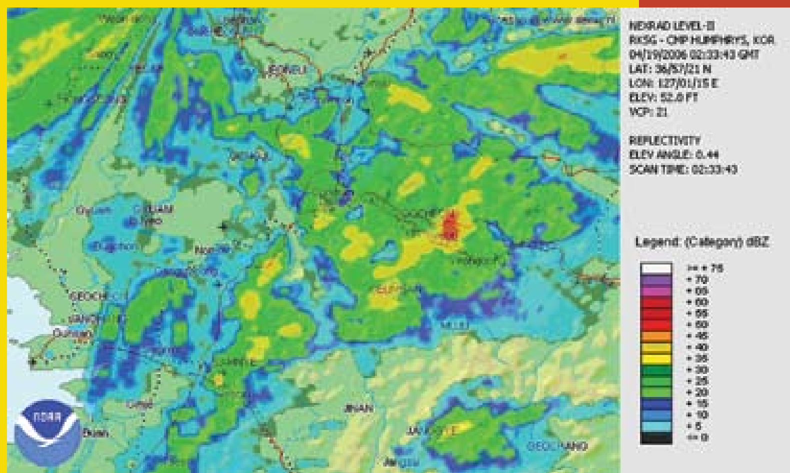
NOMADS is cited as a prototype to advance under the Global Earth Observation Integrated Data Environment (GEO-IDE) - NOAA's plan to support the US-GEO and participate within the international Group on Earth Observations (GEO). Finally, NOMADS participated with the OGC on a demonstration of distributed web-services based access conducted in Beijing, China for GEO. For more information on the NOMADS project, please visit: http://nomads.ncdc.noaa.gov/.

More Timely Access and Higher Quality Data and Products

The NCDC vastly improved its quality control processing with new scientific algorithms and by integrating additional surface data sets (Automated Surface Observing System (ASOS), Automated Weather Observing System, keyed data, and the CRN) into its integrated surface data processing system. The continued automation of the system reduced the resources required for processing, and the improvements increased the NWS sites processed through full automated quality control from 275 to more than 2,000. Climatological Summaries and products (Local Climatological Data) are now dynamically generated and users have quick access to the highest quality data (24 hours vs. 45 days previously). This advancement eliminated stove pipe processing systems, increased the number of sites processed, and decreased the time to process data and generate products. Higher quality data and information are now available sooner for users. During 2007, NCDC will be adding the NWS Cooperative Observer Program data to the integrated processing system.

Increased Weather Radar Data Available: The NCDC expanded its ingest of weather radar data from the U.S. Next Generation Radar Data (NEXRAD) to include weather radar data from Canada and Korea. Data are received in near real-time and made available as soon as possible after receipt. In addition, NCDC developed weather radar visualization and data export tools that incorporates differing data formats from various networks (U.S., Canada, Korea, the Federal Aviation Administration, etc.) and provides tools for custom data user products (overlays, animations, queries and integration with other types of data (in situ, social, etc.)). Compliant with the OGC, the Common Data Model environment and Global Earth Observation System of Systems program, this popular software is used globally by public and private sectors and is pending a NOAA patent. In addition, NCDC has coordinated and developed a mirror ingest and back-up system with its sister data center (National Geographic Data Center) in Boulder, Colorado. This redundancy ensures no lost data and continuous availability for users. NCDC is also working with the NWS National Severe Storms Laboratory supporting the National Mosaic and Multi-Sensor Quantitative Precipitation Estimates (NMQ). The NMQ generates three-dimensional mosaics of radar reflectivity and a suite of derived products including multiple rainfall products. The system has also been designed to ingest all relevant grids for rainfall estimation purposes such as multiple radar, rain gauges, satellite imagery, model output, and lightning flashes. The NMQ will improve precipitation estimates and assist in precipitation classification (snow, rain, sleet, etc.).

Data Quality Improvement Program: The NCDC, partnering with the NWS, State Climatologists, and Regional Climate Centers (RCC), implemented a web-based data quality improvement program. NOAA data users can now enter known or suspect data quality concerns into a web-based system for analysis and resolution. The system records the data quality question, responds to the user, initiates an investigation and tracks the question until it is resolved. The successful implementation of this system resulted in improved quality of NOAA's operational and historical climate data for all users.



Multiple Year Contract: The NCDC, working with the Eastern Resource Acquisition Division, negotiated a 5 year conversion contract with a monetary ceiling of $125M. This includes four CDMP contractors in Kentucky, West Virginia, North Carolina, and Maryland under a General Services Administration Schedule Contractor Team Agreement. This new contract guarantees continued stable support and a cost efficient contract for the NCDC and the government.

Historical GOES data are now available on-line through NOAA's Comprehensive Large Array-data Stewardship System (CLASS): Over 200 TB of GOES historical data covering the period 1974 to 2003 have been ingested into CLASS from NCDC's archive. For the first time, NOAA is making the entire record of GOES data available on-line via the web at http://www.class.noaa.gov. CLASS software release scheduled next spring will give users access to the earliest GOES data going back to 1974. CLASS users from all over the world, from academia to commercial companies, have found the web access to these data very useful and have already retrieved a significant volume of data using File Transfer Protocol (FTP). After registering, users can obtain data via FTP delivery and free of charge. Servicing costs apply only if data are ordered on hard media such as DVDs or tapes.

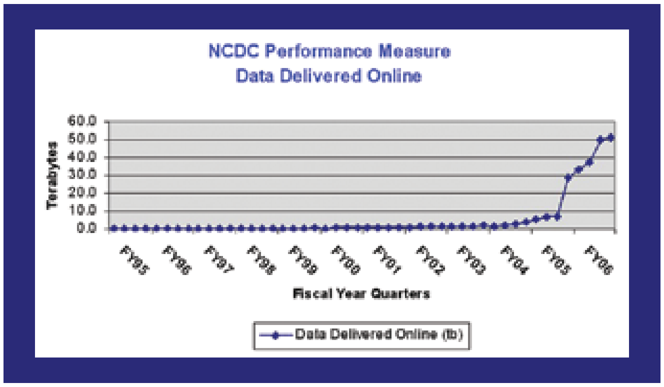
ThreadEx and Datzilla Update

ThreadEx: New daily extremes of temperature and precipitation have been developed to maximize the period of record at published Local Climatological Data sites. The ThreadEx statistics are publicly available and are in use by media groups (e.g., The Weather Channel). NOAA and the RCCs are committed to providing annual calendar year updates to these data and extending the record where possible through data rescue. This activity significantly improves data standardization of highly visible climate information for virtually all U.S. metropolitan areas. With ThreadEx, the average period of record has been extended from 67 to 95 years.

Datzilla: This data discrepancy reporting and tracking system is in operational use by the Data Operations Division (DOD), and is being routinely used by over 300 individuals and offices in NWS, RCCs and State Climate Offices. Most requests are handled within one week. The system formalized the process for correcting data in the NCDC archive, and is the basis of the newly created Data Quality Administrator position within the Data Operations Division.

FY06 Records Set for Data Access via the NOAA National Data Center (NNDC) On-line Store

During FY06, the NNDC On-line Store revenue totaled over $702,000—a new record and about 1% above the FY05 total. The value of free on-line orders for in situ data (i.e., for the datasets which commercial customers pay for on-line) exceeded $3.4 million, also a new record. The total volume of data downloaded from NCDC's various web services

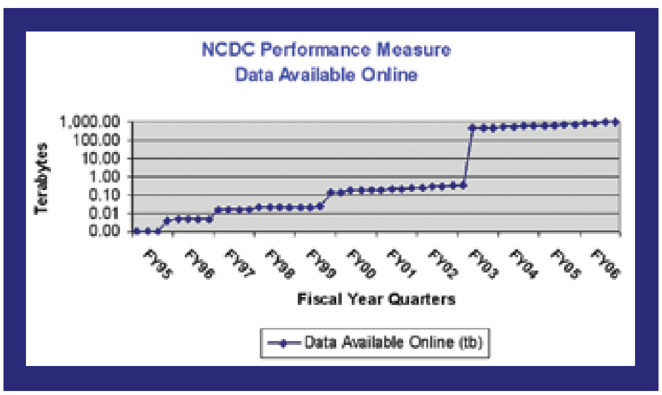


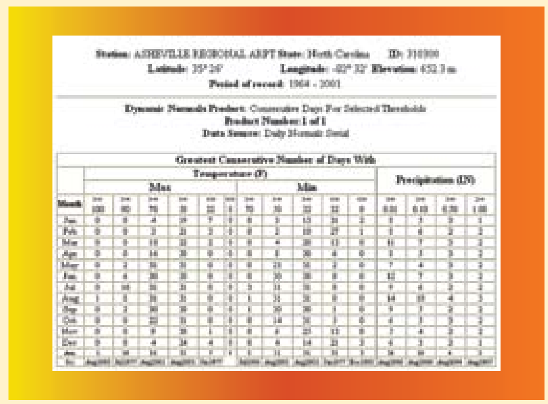
(in situ, NEXRAD, model output, satellite data) also set a record with nearly 172 terabytes downloaded, and when counted in its uncompressed form (e.g., for NEXRAD), totaled over 230 terabytes.

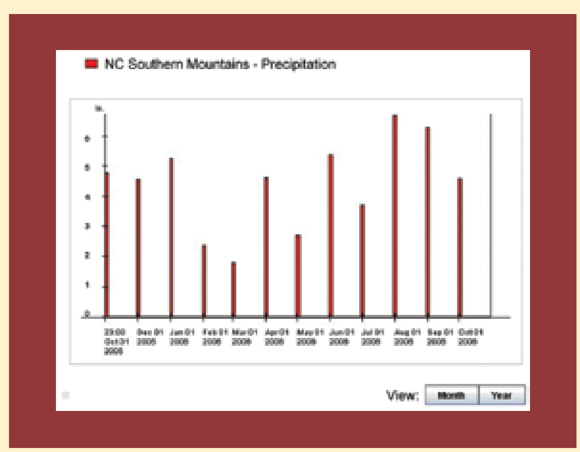
The increases in data access were due to NCDC responding to customer requirements by adding numerous new on-line products and services to the NOAA Virtual Data System (NVDS), and the expansion of CLASS services for satellite data. Also, the NESDIS e-government System (NeS) experienced 3 major milestones: 1) a new/enhanced on-line store system for on-line orders; 2) an interface with CLASS to allow customers to order large volumes of satellite data on CD or DVD; 3) the implementation of NeS for the Southeast RCC.

NOAA Virtual Data System (NVDS) Accomplishments for 2006

There were numerous NVDS accomplishments during 2006, which include new products and services via Climate Data On-line (CDO) and new features and services in our GIS. Highlights follow:







New CDO Services (http://cdo.ncdc.noaa.gov):

- A new *Quality Controlled Local Climatological Data* (LCD) product takes advantage of the new Integrated Surface Data Processing System (ISD), with extensive automated quality control applied to all of the data prior to loading into the on-line database, from which the LCD is generated. This product is updated in near real-time (daily basis), so users have quick access to quality-controlled data in an easy-to-use form. LCD forms are also now available for CRN sites, in the same format as ASOS and other sites. NOAA customers now have the ability to view CRN data for any selected time period, in the same format as other hourly reporting stations. Overall, approximately 2000 U.S. hourly reporting stations are available.

- *Global marine data for ships and buoys (Integrated Comprehensive Ocean-Atmosphere Data Set--ICOADS)* are now available on-line, with several output formats to choose from. Currently, 2005-2006 data are available on-line, and pre-2005 data will be made available over the next year.

- *Dynamic normals* allows users to select their desired location (over 12,000 stations available), time period, and parameter, and then calculate the normal/average values for the period. There are 19 products (e.g., daily cooling degree days) which use the U.S. "normals" datasets as input. This contrasts with NCDC's standard normals products, which strictly used 1971-2000 as the base period.

- *Monthly extremes* allows users to select their desired location (over 19,000 stations available), time period, and parameter, and provides the extreme values for the period. There are 30 products (e.g., maximum precipitation by month) which use mostly U.S. data as input.

- *U.S. Climate Divisional* data (1895-present) comprise the 344 climate divisions across the country, and also provide state and national averages, with temperature, precipitation, four drought indices, and heating/cooling degree days as the parameters.

- *Global Summary of Day* a product of the ISD, includes 13 parameters such as max/min temperature, daily precipitation, and snow depth, for over 10,000 global locations currently active, with summaries as far back as 1929. This product has been on-line via FTP for many years, and is now updated daily.

ISET

Interdisciplinary Scientific Environmental Technology Cooperative Science Center

NCDC Contributes to the New Center at North Carolina Agricultural and Technical (A&T) State University

NCDC has agreed to partner with the new Interdisciplinary Scientific Environmental Technology (ISET) Cooperative Science Center at North Carolina A&T State University. The other university partners are Fisk University, University of Alaska Southeast, City University of New York, California State University - Fresno, University of North Carolina at Pembroke, North Carolina State University and University of Minnesota. The mission for this center is to train students in NOAA scientific areas and develop technology and analysis techniques for improved understanding of climate change. NCDC has provided expertise in the development of several outreach initiatives. The basic research thrust areas are sensor science technology, global observing systems, and data mining and fusion.

Photo courtesy
Grant Goodge, STG, Inc.

Integrated Surface Data (ISD) Web Site

NCDC has completed a new web system regarding ISD, to tie together information about the database and its quality control, data access, ISD-derived products (e.g., global summary of day, ISD summaries, "ISD-Lite," wind rose), CD/DVD products, and various articles/papers. ISD consists of global surface observations compiled from numerous sources, into a single consistent format and common data model. It was developed as a joint activity within Asheville's Federal Climate Complex (NCDC, with U.S. Air Force and Navy partners), with the assistance of external funding from several sources. ISD Version 1 was released in 2001, with Version 2 (additional quality control applied) in 2003. Since 2003, there have been continued incremental improvements in automated quality control software.

NOAA Site-C Continuity of Operations (COOP) Support

The NCDC NOAA Site-C COOP team completed months of continuity of operations-related practice and training—at least five separate sessions were conducted between January and May 2006. Formal incident command system training was provided to key team members. New COOP action tracking procedures and systems were trained, tested, and implemented. Enhanced IT and communications support capabilities, including expanded wireless, phone, and secure/non-secure facsimile service were installed to improve the COOP command center operations. Multiple tests of secure and satellite communications systems were conducted to assure their availability when/if needed during a contingency. A COOP "dry run" drill was conducted to hone skills and procedures. This preparation culminated in participation in a government-wide COOP exercise in June 2006, called FORWARD CHALLENGE-06 (FC-06). The NCDC team prepared for, hosted, and assisted 40 NOAA deployers in advance of and during this exercise. Feedback from deployers included: "superb IT support", "best seen Action Tracker/Reports Cell operation", "extremely helpful line/staff office backup", "very effective facility/equipment setup", and "top-notch hospitality." The NOAA Site-C operation was identified as the example for others in the Department to emulate during the Dept of Commerce (DOC) post-exercise review and the DOC on-site exercise evaluator stated in his final report: "NCDC personnel provided outstanding support and accommodated the COOP staff to the maximum level."

NCDC's NOAA Site-C COOP team was instrumental in the success of NOAA COOP activities during 2006.

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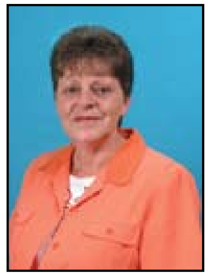
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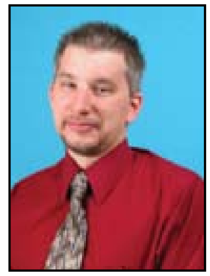
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Ansari, Steve


Arquez, Anthony


Arnfield, Jeff


Baker, Bruce


Baldwin, Rich


Barkstrom, Bruce


Bates, John J.


Bauer, Bruce


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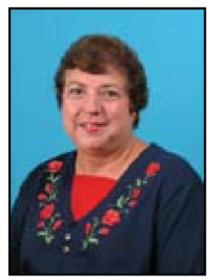
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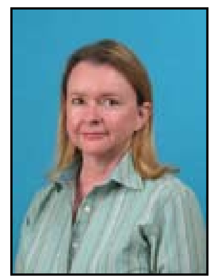
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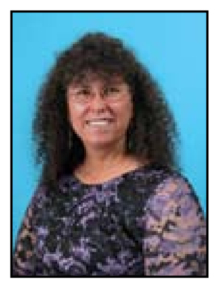
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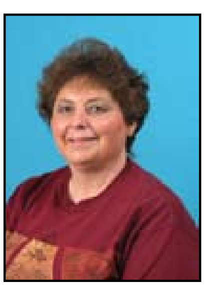
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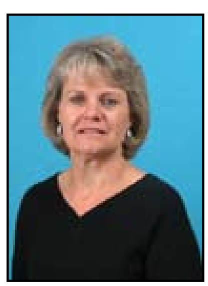
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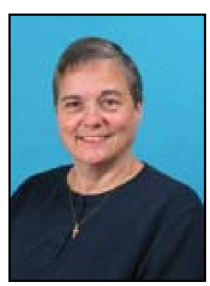
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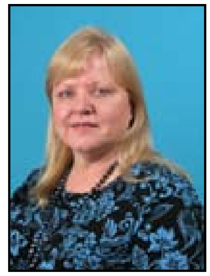
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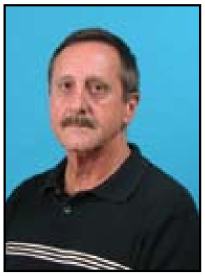
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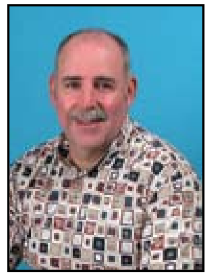
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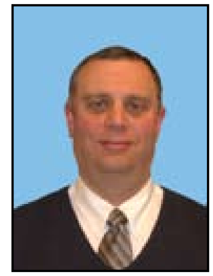
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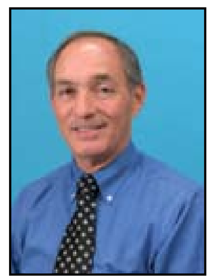
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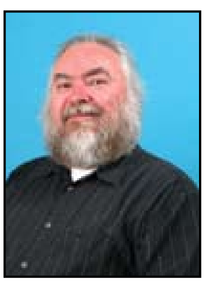
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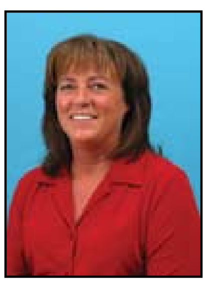
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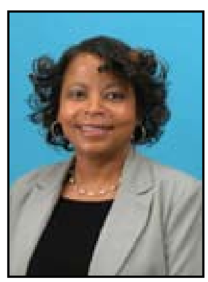
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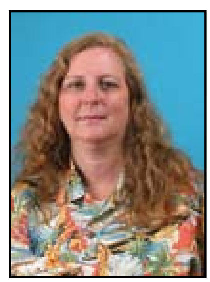
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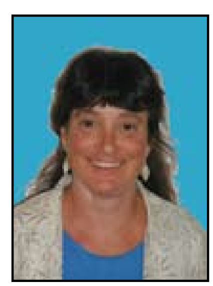
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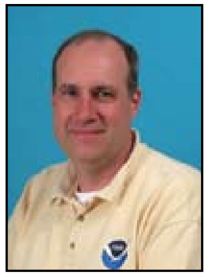
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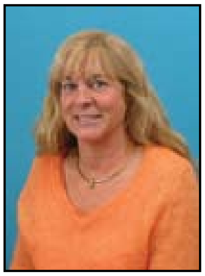
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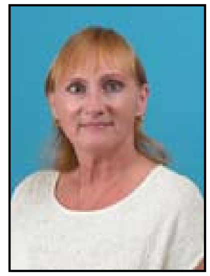
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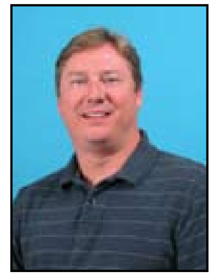
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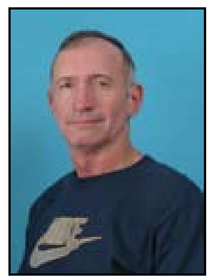
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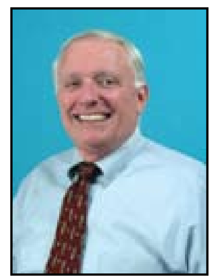
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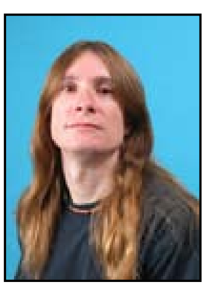
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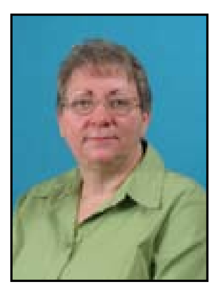
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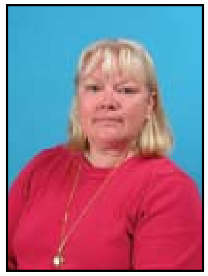
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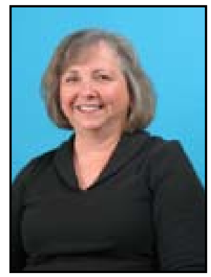
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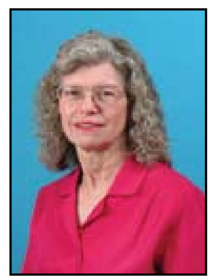
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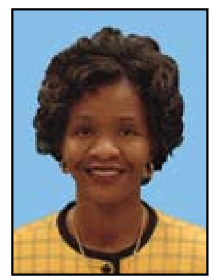
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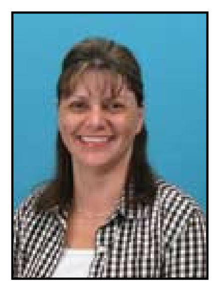
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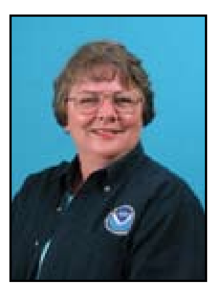
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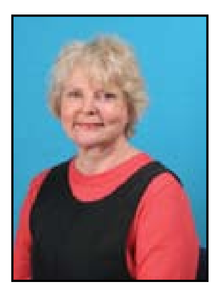
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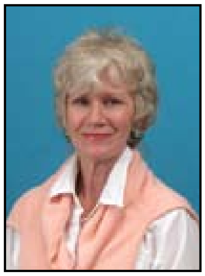
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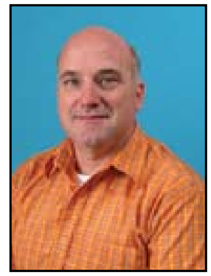
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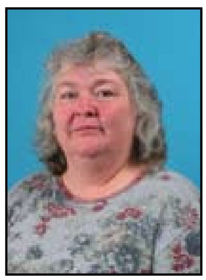
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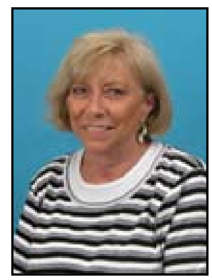
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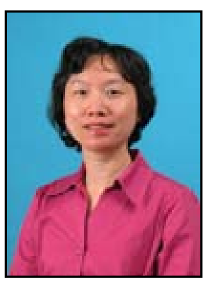
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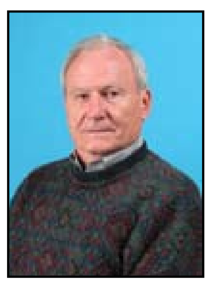
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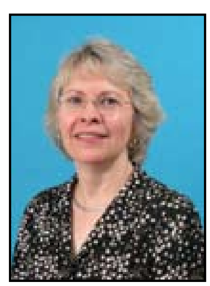
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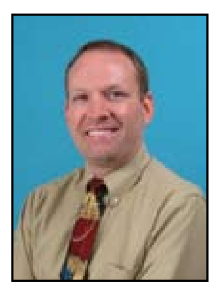
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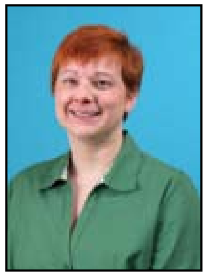
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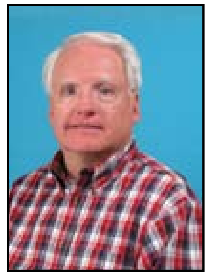
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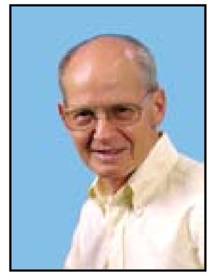
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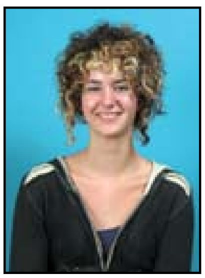
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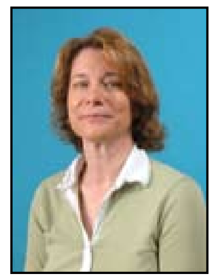
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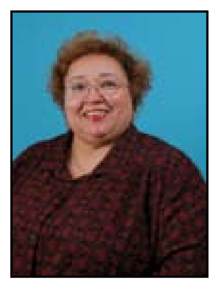
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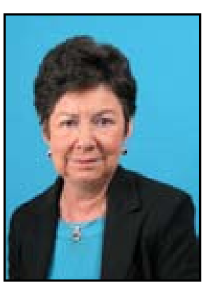
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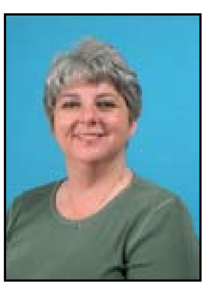
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Acronyms

A&T
North Carolina Agricultural & Technical State University

ASOS
Automated Surface Observation System

AMSR
Advanced Microwave Scanning Radiometer

AVHRR
Advanced Very High Resolution Radiometer

CCSP
Climate Change Science Program

CDMP
Climate Database Modernization Program

CDO
Climate Data On-line

CLASS
Comprehensive Large Array-data Stewardship System

COOP
Continuity of Operations Plan

CRN
Climate Reference Network

CSC
Coastal Services Center

DOC
Department of Commerce

ERD
Environmental Research Division

FAC
Federal Advisory Committee

FTP
File Transfer Protocol

FY
Fiscal Year

GCOS
Global Climate Observing System

GEO
Group on Earth Observations

GEO-IDE
Global Earth Observation Integrated Data Environment

GIS
Geographical Information System

GOES
Geostationary Operational Environmental Satellite

HCN-M
Modernized Historic Climatology Network

HURSAT
Hurricane Satellite Data Set

IDEA
Integrated Data and Environmental Applications (Center)

IPCC
Intergovernmental Panel on Climate Change

ISD
Integrated Surface Data

IT
Information Technology

LCD
Local Climatological Data

MTS
Marine Technology Society

NASA
National Aeronautics and Space Administration

NCDC
National Climatic Data Center

NCEP
National Centers for Environmental Prediction

NeS
NESDIS e-government System

NESDIS
National Environmental Satellite, Data, & Information Service

NESIS
Northeast Snowfall Impact Scale

NEXRAD
Next Generation Weather Radar

NMFS
National Marine Fisheries Service

NMQ
National Mosaic and Multisensor Quantitative (Project)

NOAA
National Oceanic and Atmospheric Administration

NOMADS
National Operational Model Archive and Distribution System

NRC
National Research Council

NVDS
National Virtual Data System

NWS
National Weather Service

OGC
Open Geospatial Consortium

PRIDE
Pacific Region Integrated Data Enterprise

RCC
Regional Climate Center

RTG
Real-Time Global

SMN
Servicio Meteorológico Nacional

SST
Sea Surface Temperature

UW
University of Wisconsin

Our mission is to provide access and stewardship to the Nation's resource of global climate and weather related data and information, and assess and monitor climate variation and change.